

<b>Notic of Allowability</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/662,991	MACAUSLAN, JOEL M.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Kimberly Thornevell	2128	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--**

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to communications filed on 9/15/2003.
2. ☒ The allowed claim(s) is/are 1-17.
3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
  - a) ☐ All    b) ☐ Some\*    c) ☐ None    of the:
    1. ☐ Certified copies of the priority documents have been received.
    2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
    3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).
  - \* Certified copies not received: \_\_\_\_\_.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.  
**THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.
5. ☒ CORRECTED DRAWINGS ( as "replacement sheets") must be submitted.
  - (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review ( PTO-948) attached
    - 1) ☐ hereto or 2) ☐ to Paper No./Mail Date \_\_\_\_\_.
  - (b) ☒ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date \_\_\_\_\_.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).
6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

**Attachment(s)**

- |   |  |
|---|--|
| 1. <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 5. <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)            |
| 2. <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                                | 6. <input type="checkbox"/> Interview Summary (PTO-413),<br>Paper No./Mail Date _____. |
| 3. <input type="checkbox"/> Information Disclosure Statements (PTO-1449 or PTO/SB/08),<br>Paper No./Mail Date _____ | 7. <input checked="" type="checkbox"/> Examiner's Amendment/Comment                    |
| 4. <input type="checkbox"/> Examiner's Comment Regarding Requirement for Deposit<br>of Biological Material          | 8. <input checked="" type="checkbox"/> Examiner's Statement of Reasons for Allowance   |
|   | 9. <input type="checkbox"/> Other _____.   |

### DETAILED ACTION

1. Claims 1-17 are pending in the instant application.

### EXAMINER'S AMENDMENT

2. An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 CFR 1.312. To ensure consideration of such an amendment, it **MUST** be submitted no later than the payment of the issue fee.
3. Authorization for this examiner's amendment was given in a telephone interview with David Thibodeau, Jr. (Reg. No. 31,671) on 5/25/2006.
4. The application has been amended as follows:

**Figure 2:** On step 54, please change "5VD" to "SVD."

**Claim 7:** On line 2, please remove the word "assumed" and insert the phrase "known in advance." Claim 7 should now read:

"A method as in claim 1 wherein the estimated number of constraints is reduced by excluding directions that are known in advance to be unconstrained."

**Claim 8:** On line 1, please remove the number "10" and insert "1." Claim 8 should now read:

"A method as in claim 1 wherein data points near or at the base point may be filtered or projected in such a way to satisfy the constraints."

**Claim 9:** On line 14, please insert the ", optionally," between the words "wherein" and "each." Please remove the phrase "assumed to be unconstrained

may be” and insert “nor among those constrained.” On line 15, please remove the phrase “in the assumption” and insert the phrase “in the method for estimating the topological dimension. Claim 9, beginning on line 14 should now read:

“wherein, optionally, each direction that is not among those constrained is weighted by a factor which reflects a confidence level in the method for estimating the topological dimension.”

**Claim 11:** On line 1, please remove the phrase “additionally comprising the step of” and insert “wherein the step of estimating the number of constraints in the neighborhood of the base point increases the number of constraints to accommodate.” On line 2, please remove the word “identifying.” Please remove the phrase “could have arisen for noisy data points if true underlying values of the” and insert the phrase “are consistent with.” On line 3, please remove the word “had” and insert the phrase “that have.” Please remove the phrase “slightly by an amount consistent with an assumed level of noise in the data,” and insert the phrase “due to noise.” Claim 11 should now read:

“A method as in claim 9 wherein the step of estimating the number of constraints in the neighborhood of the base point increases the number of constraints to accommodate constraints that are consistent with data points that have been mis-measured due to noise.”

**Claim 15:** On line 2, please remove the phrase “assumed to be” and insert the phrase “identified, in advance, as being.” Claim 15 should now read:

"A method as in claim 9 wherein the estimated number of constraints is reduced by excluding directions that are identified, in advance as being unconstrained."

**Claim 16:** On line 1, please remove the number "9" and insert the number "11". Please remove the phrase "the assumed" and insert the word "a." On line 2, please insert the word "mis-measured" between "each" and "data." Claim 16 should now read:

"A method as in claim 11 wherein a level of noise is different for each mis-measured data point."

***Allowable Subject Matter***

5. Claims 1-17 are allowed.
6. The following is an examiner's statement of reasons for allowance:

The closest prior art of record is "Higher-Order Interpolation and Least-Squares Approximation Using Implicit Algebraic Surfaces," by Chandrajit Bajaj et al., published in ACM Transactions on Graphics, Vol. 12., no. 4, October 1993.

Regarding claim 1, Bajaj discloses a method for estimating the topological dimension of a set of data points representing a nonlinear system response *using a matrix decomposition technique to find singular values and singular vectors , or eigenvalues or eigenvectors*, (page 336 section 3 first paragraph) *of a design matrix formed from basis functions constructed from data values* (page 328 section 2 first paragraph), wherein *each fit is a linear combination of a set of basis functions for which the zero-contours of the fit pass near data points and a*

*set of individual coefficients multiplying the individual basis functions (page 335 section 2.3.2). However, the claim is also directed to identifying a maximal set of non-redundant, nonlinear single-constraint fits to the data points which are in the neighborhood of a predetermined base point, in which the gradient of each fit in the neighborhood of the base point identifies the constrained direction; where the number of constraints in the neighborhood of the base point is estimated to be the same as the number of constrained directions that are linearly independent, and where the topological dimension of the set of data points is estimated to be the original number of coordinates of the data minus the number of constraints (Specification page 3 lines 19-22, page 16 lines 8-12, page 19 line 1 – page 21 line 26, also figures 2 and 3), , which is not disclosed in the prior art of record. These features, as defined in the specification, and recited in independent claim 1, render the claim novel and non-obvious over the prior art of record.*

Claims 2-8 are deemed allowable, as they depend from allowable claim 1.

Regarding claim 9, Bajaj discloses a method for estimating the topological dimension of a set of data points representing a nonlinear system response using the well-known SVD technique in order to determine constraints on the data (page 336 section 3 first paragraph). However, the claim is also directed to *identifying a maximal set of non-redundant, nonlinear single-constraint fits to the data points which are in the neighborhood of a predetermined base point, in which the gradient of each fit in the neighborhood of the base point identifies the constrained direction; where the number of constraints in the neighborhood of the*

*base point is estimated to be the same as the number of constrained directions that are linearly independent, and where the topological dimension of the set of data points is estimated to be the original number of coordinates of the data minus the number of constraints, wherein each direction that is not constrained to be unconstrained may be weighted by a factor which reflects a confidence level in the method for estimating the topological dimension* (Specification page 3 lines 19-22, page 16 lines 8-12, page 19 line 1 – page 21 line 26, also figures 2 and 3), which is not disclosed in the prior art of record. These features, as defined in the specification, and recited in independent claim 9, render the claim novel and non-obvious over the prior art of record.

Claims 10-17 are deemed allowable, as they depend from allowable claim 9.

7. Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled "Comments on Statement of Reasons for Allowance."

### **Conclusion**

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.
  - a. "Computation of the Medial Axis Transform of a 3-D Polyhedra," by Evan C. Sherbrooke et al., published by ACM in 1995, discloses finding a tangent space at each of a given set of points using the SVD technique.

- b. "Computing Local Surface Orientation and Shape from Texture for Curved Surfaces," by Jitendra Malik et al., published in the International Journal of Computer Vision in 1997, discloses identifying a set of data points representing a contour in a neighborhood where tilt direction is identified as the direction of the gradient.
  - c. "On the Decidability of Semi-Linearity for Semi-Algebraic Sets and its Implications for Spatial Data Bases," by F. Dumortier et al., published by ACM in 1997, teaches semi-linear system constraints.
  - d. US Patent no. 5,835,682, issued to Broomhead et al., teaches a dynamic system analyzer using the SVD technique.
  - e. US Patent no. 5,453,940, issued to Broomhead et al., teaches a dynamic system analyzer for a nonlinear system using the SVD technique.
  - f. US Patent no. 5,493,516, issued to Broomhead et al., teaches a dynamic system analyzer for a nonlinear system using the SVD technique.
  - g. US Patent no. 4,973,111, issued to Haacke et al., teaches a system for pattern recognition that uses the SVD technique to analyze a nonlinear system.
9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kimberly Thornewell whose telephone number is (571)272-6543. The examiner can normally be reached on 8am-4:30pm M-F.
- If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kamini Shah can be reached on (571)272-2279. The fax

phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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**KAMINI SHAH**  
**SUPERVISORY PATENT EXAMINER**